

The American STATISTICIAN

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The American STATISTICIAN

DECEMBER 1947, Vol. I, No. 3

A publication of the American Statistical Association, successor to *ASA Bulletin*.

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SPECIALIZED STATISTICAL SOCIETIES

An unprecedented increase in the number of statistical organizations has occurred in the last year. New international groups have been set up to link together the work of statisticians in specialized subjects throughout the world. The Biometric Society, the new International Association for Research in Income and Wealth, and the reorganized International Union for the Study of Population are among the more salient instances of this process of differentiation within the broad group of professional users of statistical method. Now that the blighting effects of the war are slowly disappearing, the statistical societies in the war-stricken countries are resuming activity. These manifestations of revived interest in statistics and of differentiation and specialization appear to be a symptom of vigorous intellectual growth.

As the area of statistical knowledge and inquiry expands, it becomes impossible for a single organization to serve all of the varied needs of statisticians. In statistics, especially in the United States, development has been rapid and heartening over the past decade. The development of small sampling theory and application, the emergence and general use of quality control and sequential analysis, the new applications of statistical method to the expanding range of economic problems, to biology, demography, public opinion analysis, aptitude testing, process and materials appraisal, medicine and physics, are among the more obvious examples of this growth.

The formation of specialized societies is clearly desirable, if only to insure that the more valuable contributions in each field are published and that the workers in these fields have a common forum in which to discuss and compare their particular problems.

The activity of general statistical organizations can be enhanced by interrelationships with the more specialized groups. Liaison among the various content fields using statistics will have increasing value. Fruitful methods, discovered in one area, can often be applied to widely divergent fields of analysis. Many of the problems of methodology and of the framework of the science as a whole remain unsolved and continue to challenge us. For the teacher of statistics, the compartmentalization of knowledge, research and inquiry raises new pedagogical problems. It becomes increasingly difficult for him both to keep abreast of all fundamental developments and to provide instruction which is an adequate introduction to any specific area of statistical application.

The narrow specialist in Toynbee's historic framework is one of the symptoms of the disintegration of creative minorities and hence of civilizations, but this degenerative process occurs only when the part loses contact with the whole. One of the purposes of the general statistical association is to prevent the hedges which delimit the various areas of special activity from becoming Chinese Walls which block intellectual communication and travel.

THE EDITORS

NEWS

United Nations Statistical Commission recommends program—Bureaus of Business Research, Venezuelan and public opinion statisticians form new societies—Institute of Numerical Analysis established—New publications

United Nations Statistical Commission

The Second Session of the U.N. Statistical Commission held at Lake Success from August 28 to September 5, took steps to coordinate all statistical activities of the United Nations under its leadership and to standardize statistical definitions and classifications in a broad variety of fields.

The Statistical Commission requested the Secretary-General of the U.N. to prepare a general plan for the publication of international statistical yearbooks, avoiding duplication of data wherever possible, ensuring consistency among the data used, defining the scope of each yearbook to avoid overlap, economizing on budgets, staff and lessening the burden on national governments of reporting on the same subjects to different U.N. groups.

A proposed international standard industrial classification was circulated to member governments and specialized agencies for comment. The Committee on Statistical Classification was set up and will recommend standard international classifications covering commodities entering into world trade, occupations, status and other matters.

The Commission requested the Secretary-General to issue a memorandum to member governments containing information on statistical methods, sources and formulae used in time series in order to obtain better and more uniform reporting.

The United States member of the Statistical Commission is Stuart A. Rice, Assistant Director of the Budget Bureau. Copies of the Commission's report (U.N. Document E/577, September 23, 1947) may be obtained from the Statistical Office, United Nations, Lake Success, N. Y.

Bureaus of Business Research form new organization

Representatives of most of the university research bureaus concentrating on business and economic research met in a three-day conference in Washington, October 20-22. A formal organization to be known as Associated University Bureaus of Business and Economic Research was established. Dr. Robert W. French of the University of Texas was elected President and Dr. John H. Cover, University of Maryland, Secretary-Treasurer. The conferences, in which professional representatives of Federal and international government agencies participated, covered the following topics: Current Business Analysis, Labor Force and Employment,

Prices and Price Measurement, Consumer Credit and Finance, Building and Construction, and International Trade and Finance.

An executive committee of the organization will consist of the two officers and of Frank L. Kidner, University of California; H. H. Chapman, University of Alabama; and H. K. Allen, University of Illinois.

A second annual meeting of the organization will be held in the Middle West in October of 1948. In addition, it is the intention of the group to collaborate with various learned societies in professional programs.

Institute of Numerical Analysis established

Plans have been completed for the establishment of one of the newest units of the National Bureau of Standards—the Institute of Numerical Analysis—at the University of California at Los Angeles, according to an announcement by Dr. Edward U. Condon, Director of the Bureau.

One of the giant high-speed electronic computing machines, now under development by the Bureau of Standards, will be installed at the Institute when completed.

The Institute has two primary functions. The first is research in applied mathematics aimed at developing methods of analysis which will extend the use of the high-speed electronic computers. The second is to act as a service group for Western industries, research institutions, and government agencies. The service function will include not only the use of the machine for problem solving but also assistance in the formulation of problems in applied mathematics of the more complex and novel types. Service operations are to be initiated immediately, using the latest commercially available computing equipment.

Graphics Exhibit for ASA Annual Meeting

Most of the graphics exhibit displayed at the recent International Statistical Conferences will be shown at the American Statistical Association's annual meeting in New York in December. This exhibit was prepared under the direction of the Association's Committee on Presentation, and contains several hundred examples of uses and techniques of graphic presentation selected from a wide cross-section of Government and business statistical activity.

LESTER S. KELLOGG RESIGNS AS SECRETARY-TREASURER OF THE AMERICAN STATISTICAL ASSOCIATION

The American Statistical Association announces with deep regret that Lester S. Kellogg is resigning, effective January 1, 1948, as Secretary-Treasurer of the Association and as Managing Editor of its publications. Mr. Kellogg will leave Washington to accept an executive position with Deere and Company, makers of agricultural implements, in Moline, Illinois.

During the five years that Mr. Kellogg was Secretary of the American Statistical Association membership more than doubled. Although he was in charge of one of the key divisions in the Department of Labor, Mr. Kellogg found time to cope with the new problems which the Association faced in wartime and to expand its activities to meet these additional needs.

Co-author of the well-known text, *Business Statistics*, Lester Kellogg was an Assistant Professor of Statistical Research at Ohio State University prior to the outbreak of the war. In 1940, he came to Washington to edit the Weekly Progress Report of the National Defense Commission, a confidential weekly bulletin providing a comprehensive statistical picture of the American armaments program.

In 1942, Mr. Kellogg transferred from the War Production Board to the Department of Labor, where he has headed the Prices and Cost of Living Branch of the Bureau of Labor Statistics since 1945. The work of this Branch during and after the war was of critical importance in providing measures of price movements as a guide to inflation.



LESTER S. KELLOGG

Mr. Kellogg has shown unusual qualities of imagination and judgment in guiding the Association during a period of new problems and unparalleled growth.

Appraisal of Soviet statistics

Five economists and statisticians internationally known for special studies in Russian and income statistics took part in a symposium appraising Russian economic statistics which is published in the November issue of *The Review of Economic Statistics*.

The main conclusion, although supported only with reservations by Abram Bergson and not supported by Aaron Yugow, was that the Soviet Union's economic potential has been exaggerated by official Soviet statistics that have an upward bias into a "badly distorted" version of economic growth. The discussion analyzes the statistical techniques used by the Soviet regime. No charge is made that the Government "manipulates its statistical series, but the refusal to publish price indices, considered together with the so-called use of 1926-27 prices for the purpose of measuring output, suggests an intention to present a biased statistical picture."

The other participants were Colin Clark, Alexander Gerschenkron and Paul A. Baran. Mr. Clark dealt with general problems of interpretation of Russian statistics, and particularly with series on income and productivity; Dr. Gerschenkron with the Russian production index; Dr. Bergson with wage and labor statistics; and Mr. Yugow with the place of statistics in Russian planning.

These studies, initiated by the economics department at Harvard and carried on, in one instance, in the Russian Institute at Columbia University, are among several studies of Russian statistics carried out recently at several of the Russian institutes set up in recent years at American universities. Among studies published by American universities were surveys of the Russian economic system by Dr. Harry Schwartz, Syracuse University, and of Russian commerce by Dr. Mikhail V. Condoide, Ohio State University.

See page 9 for more news

107th Annual Meeting of the AMERICAN STATISTICAL ASSOCIATION

December 28 through 30, 1947, Hotel Commodore, New York City

SUNDAY—DECEMBER 28, 1947

9:00 a.m.	Registration
Permanent Exhibit	Display of Graphics Prepared by the American Statistical Association Committee on Graphic Presentation
Permanent Exhibit	Display of Publications in the Fields of Statistics, Sociology, Mathematics and Biology
10:00 a.m.—12:00 m.	Status and Prospects in Methods of Social Research <i>Joint with the American Sociological Society</i>
10:00 a.m.—12:00 m.	The Teaching of Statistics A Review of the Present Situation and Recommendations <i>Joint with the Institute of Mathematical Statistics</i>
10:00 a.m.—12 m.	Progress in the Industrial Classification of Establishments
1:15 p.m.—3:15 p.m.	Status and Prospects in Population Plans <i>Joint with the American Sociological Society</i>
1:15 p.m.—3:15 p.m.	Establishment Sampling—A Round Table
1:15 p.m.—3:15 p.m.	The Basic Introductory Course for Undergraduates <i>Joint with the Institute of Mathematical Statistics</i>
3:30 p.m.—5:30 p.m.	International Problems in Health and Vital Statistics <i>Biometrics Section of the American Statistical Association</i> <i>Joint with The Biometric Society</i>
3:30 p.m.—5:30 p.m.	Measurement and Significance of Inventories
3:30 p.m.—5:30 p.m.	Patterns of Working Life

MONDAY—DECEMBER 29, 1947

9:00 a.m.—11:00 a.m.	Operational Research <i>Joint with the Institute of Mathematical Statistics</i> (With the cooperation of the Operations Evaluation Group of the Navy and Operations Analysis of the Air Force)
9:00 a.m.—11:00 a.m.	More Adequate Current Reports on Industrial Activity
9:30 a.m.—12 m.	Some Aspects of Graphic Presentation
10:00 a.m.—12:00 m.	Statistical Problems in Highway Planning and Transport Research
11:00 a.m.—1:00 p.m.	The Current Status of Federal Statistics—A Round Table
12:00 m.—3:15 p.m. Luncheon	Committee on Census Enumeration Areas

1:15 p.m.—3:15 p.m.	Social Psychology <i>Joint with the American Sociological Society</i>
1:15 p.m.—3:15 p.m.	More Accurate Industrial Statistics
1:15 p.m.—3:15 p.m.	Biometrics Section—Contributed Papers
3:30 p.m.—5:30 p.m.	Operational Research and other Military Applications of Statistics <i>Joint with the Institute of Mathematical Statistics</i> (With the cooperation of the Operations Evaluation Group of the Navy, and Operations Analysis of the Air Force)
3:30 p.m.—5:30 p.m.	Problems in Measuring the Volume of Housing Construction Activity
3:30 p.m.—5:30 p.m.	Institute of Mathematical Statistics—Business Meeting
5:30 p.m.—6:30 p.m.	American Statistical Association—Annual Business Meeting
8:00 p.m.—10:00 p.m.	Presidential Addresses <i>Joint with the American Sociological Society</i> Willard L. Thorp, President, American Statistical Association Louis Wirth, President, American Sociological Society

TUESDAY—DECEMBER 30, 1947

9:00 a.m.—11:00 a.m.	Housing <i>Joint with the American Sociological Society</i>
10:00 a.m.—12:00 m.	Descriptive Statistics in the Service of Life Insurance
9:30 a.m.—12:30 p.m.	Application of the Theory of Extreme Values <i>Joint with the Institute of Mathematical Statistics</i>
1:00 p.m.—3:15 p.m. Luncheon	Outlook for 1948
1:15 p.m.—3:15 p.m.	Progress Report and Discussion on the Measurement of Productivity in Industry
1:00 p.m.—3:15 p.m. Luncheon	Biometrics Section—Business Meeting
1:15 p.m.—3:15 p.m.	Statistical Techniques in Life Insurance <i>Joint with the Institute of Mathematical Statistics</i>
3:30 p.m.—5:30 p.m.	Census and Vital Statistics <i>Joint with the American Sociological Society</i>
3:30 p.m.—5:30 p.m.	The Use of Statistics by Business Management
3:30 p.m.—5:30 p.m.	American Statistical Association—Contributed Papers
3:30 p.m.—5:30 p.m.	Institute of Mathematical Statistics—Contributed Papers
3:30 p.m.—5:30 p.m.	The Biometric Society, Eastern North American Region—Business Meeting

Copies of the full program may be obtained from the office of
the American Statistical Association
1603 K Street NW, Washington 6, D. C.

Sampling Opinion, Attitudes, and Consumer Wants*

by **FREDERICK F. STEPHAN** and **PHILIP J. MCCARTHY**
Princeton University Cornell University

Rapid progress has been made during the last two decades in measuring attitudes, surveying opinion, and analyzing consumer wants. Improved methods of sampling human populations are a major part of this advance. They are both swelling the flow of significant data and sharpening their analysis. Their contributions are already numerous in social psychology, economics, political science, sociology, and many fields of practical application such as market research and agriculture.

While further progress in sampling is to be expected, the time seems ripe to examine critically what has been accomplished and weld together in expository bulletins the fundamental facts and principles that are now available for use in research. This is being undertaken as the first project of the Committee on Measurement of Opinion, Attitudes and Consumer Wants established jointly by the National Research Council and the Social Science Research Council under the chairmanship of Samuel A. Stouffer of Harvard University. The other members of the committee are Samuel S. Wilks (vice-chairman), P. G. Agnew, Edward Battey, Hadley Cantril, Archibald M. Crossley, W. Edwards Deming, Robert F. Elder, George Gallup, Philip M. Hauser, Carl I. Hovland, Paul F. Lazarsfeld, Rensis Likert, D. B. Lucas, Elmo Roper, Walter A. Shewhart, Frank Stanton, C. L. Warwick.

The Committee has launched two other studies, one of them on interviewing biases, the other on the use of repeated surveys of the same panel of respondents. Plans for these projects will be worked out so that each will contribute effectively to the others and the results will fit together in the broader field of survey methods.

Growth of modern sampling methods

About twenty years ago the first substantial beginnings of modern sampling methods began to emerge from social surveys in England and America, agricultural experiments in England, America and India, and market research and engineering in America. Many instances of the progressive evolution of the techniques and their adjustment to particular needs might be cited. For example, in 1930, the SSRC sponsored the

preparation of a detailed plan for a study of family consumption at different income levels; this plan contained a unique sampling procedure keyed to the research problems that were of central importance in the study. During the mid 1930's the WPA program included large-scale sample surveys of real property, work relief, unemployment, health, family income and expenditures, retail prices, and other subjects. At approximately the same time the Gallup, Roper, Crossley and other public opinion polls were launched with improved sampling methods based on quota controls.

The Department of Agriculture and Iowa State College started an intensive program of research on agricultural sampling after the Ames conference in 1936. The Census Bureau likewise made studies of sampling methods and used sampling procedures extensively in the 1940 census, especially to produce data needed for research on family characteristics, fertility, occupations, etc. Following these developments there came a rapid growth of sampling surveys by public and private organizations.

Throughout this period of rapid expansion, workers in some fields developed their sampling methods somewhat independently of the most recent developments in other fields. This condition arose naturally since the workers in a particular field were influenced primarily by those factors that were of peculiar importance in their own situations. As a result of this independent work on tailor-made sampling methods, many disagreements on facts and principles arose. Although there was some tendency to bring together these diverse lines of development, it was not adequate to produce agreement on essential points or to produce a synthesis of results that had been achieved. In addition, misunderstandings arose from variations in terminology. The resultant confusion tended to obscure the great improvement that had been made on all sides.

Direct comparisons

The Committee on Measurement of Opinion, Attitudes and Consumer Wants initiated its studies of sampling

* Reprinted with minor revisions from *Items*, published by the Social Science Research Council, Vol. 1, No. 2, June, 1947.

by requesting its vice-chairman, Samuel S. Wilks of Princeton University, to make a preliminary survey of data available in the files of survey research agencies in order to find out whether the principal questions could be answered by a direct comparison of surveys that had been taken under essentially equivalent conditions, but by different sampling methods. This study was done in the early part of 1946 by Philip J. McCarthy under Mr. Wilks' direction and included inquiries of 19 survey agencies and similar research organizations. It revealed the fact that, apart from national surveys, there was so much variation in the questions asked, the populations sampled, the dates of the surveys, and other pertinent factors, that there was little likelihood of finding two strictly comparable surveys taken by different sampling methods that would provide a test of the relative reliability of these methods. Moreover, accurate check data to test the results of the surveys were lacking, especially on opinion and attitude questions (as distinguished from questions about objective facts). Consequently such comparisons as might be possible would show whether the two methods gave similar or different results but would not show which was the more reliable when the results differed.

An analysis of other approaches to the problem was also made, especially with respect to the possibility of arranging with survey agencies in advance to include certain standard questions in future surveys and to make their surveys comparable in other ways. In addition, the possibility of experimental sampling in various forms was considered. While this study did not discover any rich deposits of data from previous surveys for a direct comparison of methods of sampling, it did provide basic information on the range of the methods currently in use in this field and it clarified the problems involved in analyzing the relative effectiveness of different sampling methods under various conditions and for various uses. From this study it was concluded that further progress must be based on advance planning for future surveys, not only with respect to possible direct comparisons but also with respect to the component parts of sampling survey procedure.

Analytical studies

The cooperation and interest of survey organizations in the work of the committee contributed greatly to these and subsequent inquiries. In June, Frederick F. Stephan of Cornell University became director of the studies of sampling for the committee. Exploratory studies were undertaken to develop detailed procedures for the analysis of sampling methods on such factors as the component cost rates, accuracy and

biases in selection of respondents, working rules and practices employed by interviewers, qualifications required for interviewing, variability of interviewer performance, selection of appropriate units of sampling, use of prior information in designing samples, and techniques of estimation from sample data. Further work was done on the possibilities of artificial experiments with data selected to approximate actual sampling situations.

A conference of sampling experts, held at the New York office of the SSRC in October 1946 to discuss the tentative program that had been outlined in the course of these studies, contributed substantially to the development of the program and brought to light a number of significant experimental studies bearing on the problems. This group continues to serve as advisers to the committee's staff for the project.

The preparatory work led to a number of specific studies that are now under way. They include:

- (a) Analysis of the fundamental principles that underlie various methods of sampling used in surveys of opinion, attitudes, wants, and other human variables
- (b) Description and comparison of the principal sampling systems in current use; conference with survey and research agencies
- (c) Inquiries to determine how interviewers operate in fulfilling their assignments, including techniques or methods they develop more or less spontaneously, in the course of their experience, to solve problems they encounter
- (d) Comparison of the characteristics of respondents selected in the same city by two or more interviewers with similar assignments
- (e) Analysis of time required for interviewing and for travel between interviews under various conditions
- (f) Study of families that refused to be interviewed or were not at home when the interviewer called, to determine the effect of these losses and the value of making repeated "call-backs", and analysis of data on the daily cycle of absence from home
- (g) Study of the geography and human ecology of cities and rural areas to determine how knowledge of the spatial distribution of various kinds of people can be used to improve sampling methods
- (h) Systematic collection of data on the variability of typical opinion variables and other characteristics that are pertinent to planning a sampling survey
- (i) Analysis of certain tests and experimental comparisons of sampling methods recently made by survey agencies and preparation of plans for further experiments.

The results of these and related studies will be combined in the report of the project. This report will not only be an exposition of sampling methods as they have been developed to date but will also discuss systematically the considerations which must be taken into account when choosing a sampling method for a particular situation. An outline of problems for further research will be included with suggestions for obtaining information in the course of regular surveys that will lead to further improvements.

The Training of Statisticians

Harold Hotelling, Chairman of the Committee on the Teaching of Statistics* of the Institute of Mathematical Statistics, has prepared this brief summary of the Committee's report to the Board of Directors of IMS. Professor Hotelling will discuss the subject more fully in "Symposium on Probability and Statistics" to be published by the University of California Press. The Committee's report will be published in full in "The Annals of Mathematical Statistics".

SUMMARY OF CONCLUSIONS

1. Some knowledge of statistical method should be a part of a general liberal education and should be acquired by all college students.

2. Additional instruction in statistics is needed by future users of statistics such as business executives and government administrators, and still more by research workers of many kinds. For example, specialists in business research, economics, population problems, sociology, personnel selection and management, public opinion polling, biology, agriculture, metallurgy, physics and psychology need an extensive knowledge of the mathematical basis of statistical methods, since they must frequently use advanced techniques in the statistical portions of their own research, and even devise new mathematical statistical methods for their special purposes.

3. A still higher level of study of mathematical statistics, with the necessary supporting mathematics, is needed by the future teachers of statistics, including especially the teachers of nonmathematical statistics, and by research workers in the theory of statistics and professional statisticians of high grade. These constitute the smallest of the various groups, but in many respects the most crucial, since the statistical activities of the others depend ultimately on those of the creators and teachers of statistical methods and theory.

4. The organization of the teaching of statistics should be in either a Department of Statistics or in an Institute of Statistics which might (as at the University of North Carolina) include a service agency for practical statistics together with two departments, one giving instruction and carrying on research in the mathematical theory of statistics, and the other in techniques of applied statistics. Serious consideration

should be given in each institution to the unification of the various statistical laboratories, and there should be a central statistical library containing all important contributions to the theory and methods of statistics possessed by the institution.

5. The first course in statistics taught each student should be in the Department of Statistics. This department should have two general beginning courses, one requiring calculus as a prerequisite and the other only high-school algebra. Efforts should be made to induce as many students as possible to learn calculus and then take the course requiring it. After the first course, there should be work in the application of statistical methods to economics, psychology, engineering and other fields; this work might be either in the respective departments concerned with the applications or in the Department of Statistics, according to the distribution of professorial talents in the particular institution; but all those teaching any of these courses should be well acquainted with the mathematical theory of statistics as well as with the field of application. Advanced courses in statistical theory, as well as the beginning ones, should be in the province of the Department of Statistics.

6. Teachers of statistical theory and method appointed in the future should be scholarly specialists in statistical theory and method, not merely workers in one or another of the many fields in which statistics can be used.

7. Teachers of statistical theory and method should currently engage in research in these subjects, since

* *Members of the Committee:* Harold Hotelling, (Chairman), Professor of Mathematical Statistics and Associate Director, Institute of Statistics, University of North Carolina; Dr. W. Edwards Deming, Division of Statistical Standards, Bureau of the Budget, Washington, D. C.; Dr. Walter Bartky, Dean of Arts and Sciences, University of Chicago; Dr. Milton Friedman, Associate Professor of Statistics, School of Business, University of Chicago; Dr. Paul G. Hoel, Associate Professor of Mathematics, University of California, Los Angeles.

otherwise they are in danger of soon being left behind in the rapid progress of the subject and thus getting into the position of teaching the wrong things.

8. The training of teachers of statistics should include considerable higher mathematics, with matrices and theory of functions as the extreme minimum requirement, and much more mathematics is highly desirable. Such training should also involve thorough study of the mathematical theory of statistics, together with practice in applied statistics. The time required for all this exceeds that ordinarily allotted for graduate work leading to the Ph.D. degree. A solution of the time problem may be sought in three directions:

(a) By increasing the number of years required for the doctorate. This is undesirable and practically impossible.

(b) By means of postdoctoral fellowships, or by internships in government or industry, whereby the

young doctor will work under the direction of competent statisticians in applying the mathematical theory to specific practical problems. A few such internships are now available through the Graduate School of the United States Department of Agriculture. Expansion of this and similar programs is much to be desired.

(c) By getting the preliminary mathematics taught at earlier ages. The committee suggests that elementary calculus be taught in high schools to students aged 17, as is done in Europe, and also that certain parts of mathematics ordinarily reserved for graduate students be taught in kindergarten and grammar school. Implementation of these suggestions will require school teachers with a knowledge of higher mathematics comparable with that of European teachers, rather than the lower levels of mathematical training that have been customary for school teachers in this country.

NEWS continued from page 3

Statistical Association formed in Venezuela

The Venezuelan Statistical Society was organized in Caracas on April 24, 1947. This organization resulted from the efforts of a group of professionals whose stated purpose is to promote the study and increased utilization of statistics. The President of the new group is Vicente Gonzalez, Chief of the Section of Economic Statistics of the State Statistical Office, and the Secretary General is Jose V. Montesino Samperio, Statistician in the Office of Agricultural Economics, Ministry of Agriculture.

News about mathematical computing machinery

Beginning with the October issue, the quarterly journal *Mathematical Tables and Other Aids to Computation* will publish a new feature section, "Automatic Computing Machinery," designed to disseminate information and news on research and development in the field of high-speed automatic calculating machinery. Material will fall under the general headings of Bibliography, Technical Developments, Discussion (including correspondence), and News. Contributions to this section are invited and should be addressed to Dr. E. W. Cannon, Head of the Mathematics Group, Machine Development Laboratory, National Bureau of Standards, Washington, D. C.

The journal can be obtained from the National Academy of Sciences, 2101 Constitution Avenue, Washington, D. C.

"Items," New Social Science Research Council Publication

launched in March 1947, is issued for the purpose of keeping social scientists and the major publications in the social science field informed of the Council's activities. The editorial office is at 230 Park Avenue, New York City 17.

Part-time research workers wanted

Women interested in doing occasional part-time research work in statistics in Washington, D. C. are invited to place their names on a list of available workers kept by the secretarial office of the American Statistical Association, 1603 K. St., N.W., Washington 6, D. C.

International Year Book of Agricultural Statistics

The Food and Agriculture Organization recently announced publication of three new volumes of the *International Year Book of Agricultural Statistics*. The new volumes cover the war years 1941-42 through 1945-46 and provide global statistics on production, acreage and international trade for the principal crops and animal products. A statistical survey of developments in world agriculture during 1946-47 is in progress.

The *Year Books* are being compiled in Rome, as was the case before the War. FAO supervision is the responsibility of Howard R. Tolley, formerly Chief of the Bureau of Agricultural Economics, U. S. Department of Agriculture, and currently heading the economic and research activities of FAO. Direct supervision is by Irvin Holmes, formerly of the Department of Agriculture.

Census Bureau County Data Book

The County Data Book recently published by the Bureau of the Census is a presentation of significant social and economic data for every county in the United States. Most of the 91 items included are from reports of the 1940 decennial census, but a number of more recent items are also included. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for \$2.75.

Statistical Practices in Hospitals

Condensed from "The Development and Use of Statistical Practices in Hospital Work," published in *Biometrics*, September, 1947

by PAUL M. DENSEN

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As long ago as 1863 Florence Nightingale proposed the tabulation of "seven elements required to obtain a uniform record of facts from which to deduce statistical results, among which the following may be mentioned:

- "1. The total sick population—i.e., the number of beds constantly occupied during the year by each disease for each age and sex.
- "2. The number of cases of each age, sex, and disease submitted to (medical or surgical) treatment during the year.
- "3. The average duration in days and parts of a day of each disease for each sex and age.
- "4. The mortality from each disease for each sex and age.
- "5. The annual proportion of recoveries to beds occupied and to cases treated for each age, sex and disease."

Reasons for recent interest

Today, nearly a century later, the barest beginning has been made along these lines and many hospitals would still experience considerable difficulty in "deducing" all of the statistical results desired by Miss Nightingale. It may be enlightening to inquire as to the reasons for this lag and for the recent upsurge of interest in this problem.

It must be realized that the hospital "exercises a powerful influence on the pattern of medical and health care in a community." Steadily rising hospital costs per patient day coupled with rising admission rates have focused attention on the need for more factual data to define the extent and nature of the problems which the hospitals are facing. These problems are population problems. Only by a much more intimate knowledge of the medical care problems of the community from the consumer's as well as the producer's standpoint is it likely that the hospital will be in a position to evaluate the future demands which may be made upon it and to discharge efficiently its functions as a community agency. Realization of the need for specific rates in studying these problems is having its influence in the development and use of

statistical practices in hospital work.

Another force operating to produce widespread interest in hospital statistics has been the increasingly quantitative nature of medicine. A growing number of medical schools with teaching hospitals attached have incorporated courses in medical statistics in the curriculum. The medical man is being trained to think in terms of groups as well as in terms of the individual, all of which produces a favorable environment for the development of hospital statistics.

The lack of mechanical equipment for handling large masses of data probably has had a great deal to do with the tardy growth of statistics in the hospital field. It has really only been since the first World War that punch card equipment has come into widespread use. The punched card method is not confined to large hospitals. Small hospitals can punch cards and arrange to have them tabulated elsewhere, or several hospitals may engage in a cooperative arrangement.

Basic elements needed for hospital statistics

The primary source of data is the hospital record of the patient. A hospital record's primary function is to help in the treatment of the patient. It is so intimately tied to the individual, however, that many of its research and study uses may be overlooked because the emphasis in such work is on the mass of records and not on the group of individuals they represent.

Even with respect to the group, hospital records have certain peculiarities. A hospital record has to take care of a tremendous variety of things. It is not directed toward obtaining information on one particular phase of the situation. Also the record is made out and used by a great many different people. Hence, it must be relatively simple.

One of the greatest drawbacks to the statistical exploitation of the data in the hospital histories lies in the fact that emphasis in history-taking is upon the positive findings. All too often negative findings are not recorded. This difficulty has been recognized and

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the remedy proposed is a form so designed that definite questions are asked for items which form a part of every history. For other items whose appearance depends upon the circumstances surrounding the individual case, blank space is left for the physician to record his observations.

The adoption of a unit record system has aided in the development of the statistical uses of the records. This system provides that the first time a patient appears at the hospital he is assigned a number which remains unchanged no matter how often or over how long a period of time he continues to appear at the hospital and all observations which are made upon him are incorporated in one record which bears this number. Most hospitals at the present time have adopted the unit record system, and new statistical uses are constantly being found for the data in the records.

Broadly speaking, the statistical uses to which the information in the hospital may be put can be categorized in terms of the universe of discourse to which they refer. We may study, for example, the age distribution of individuals appearing in the syphilis clinic and diagnosed as having syphilis. The statistical universe here is limited to a particular kind of case appearing in the syphilis clinic. We may also be interested in the prevalence of various kinds of disease conditions among the different individuals who come to the hospital. We are then dealing with the hospital universe.

A third universe which must be recognized in relation to hospital statistics is the population from which the individuals coming to the hospital are drawn. For any one hospital, this is usually an extremely difficult population to define quantitatively. The task is somewhat simplified when all the hospitals in a community are considered.

Classification problems

Certain technical statistical problems need to be solved before much headway can be made in the analysis of hospital data. Most of these are problems of classification. For example, the clinician who wishes to work with a sample drawn from the "case" universe desires to get all the cases of a given kind together. It is important that his colleagues use the same term for indications of the same set of conditions. It is especially important if any attempt is to be made to combine the statistics of several hospitals. This difficulty has long been recognized and several nomenclatures were developed to meet this need around the turn of the century. By 1928 the need for unification resulted in the National Conference on Nomenclature of Disease which brought out a Standard Classified Nomenclature of Disease. The publication of this list has since been taken over by the American Medical Association

and by 1935 had been adopted by nearly 500 hospitals in the United States and Canada.

A nomenclature, however, is only the first step in the study of problems related to the "hospital" universe or to the population which the hospital serves. A classification of disease for statistical purposes is also needed to group the diagnoses so that they may be presented in meaningful tabular form and, with the aid of an alphabetical index, "a reasonably intelligent diagnosis coder may assign diagnostic statements to the various categories of the list as accurately as is possible from the stated causes of illness." In 1936 J. Berkson ("A system of codification of medical diagnoses for application to punch cards, with a plan of operation," *American Journal of Public Health*, 26: 606-612, 1936, and "Tabular outline for use in reporting hospital morbidity," *Proceedings, Staff Meeting, Mayo Clinic*, 11: 396-400, 1936) presented such a classification and a plan for meeting the needs of the clinician who wishes to get all the cases of a particular diagnosis and, also, the statistical requirements of periodic statistical summaries of medical conditions. The International List of Causes of Death served as the basis for Berkson's tabular outline for the classification of disease terms because it "has the widest current use for purposes of statistical enumeration."

As a result of experience gained with this and other lists a committee of consultants appointed by the Surgeon General of the United States Public Health Service evolved a more general "Diagnosis Code for Tabulating Morbidity Statistics" in 1940.

At the Fifth International Conference for the Revision of the International List of Causes of Death, Paris, 1938, it was recommended that "the United States Government continue its studies of the statistical treatment of joint causes of death." The United States Committee on Joint Causes of Death appointed for this purpose "decided that before taking up the matter of joint causes it would be advantageous to consider classification of disease from the point of view of morbidity and mortality since the joint cause problem pertains to both types of statistics." A subcommittee drafted a Proposed Statistical Classification of Diseases, Injuries and Causes of Death which was submitted in 1946 and adopted by the U. S. Committee on Joint Causes of Death. After a number of further corrections the committee turned this Proposed Classification over to the Interim Commission of the World Health Organization in March 1947.

With the development of classifications of disease, knowledge of the extent and causes of illness in the population also began to grow. Most of this knowledge is the result of special surveys except for such information reported for certain notifiable diseases.

Studies of hospital morbidity

In 1913 Frederick L. Hoffman presented the statistics of the Johns Hopkins Hospital from 1892 to 1911. His monograph was an excellent demonstration of what could be done in studying the records of one hospital. In the same year C. F. Bolduan proposed the adoption of a plan for collecting morbidity statistics from all the hospitals in a community utilizing a procedure similar to that by which data on death certificates were compiled. Essentially his idea was to have a "discharge certificate" sent to a central collecting agency each time a patient was discharged from the hospital. The central agency would then code and tabulate the data on the certificate. The greatest deterrent to the adoption of this scheme was the difficulties which were encountered in classifying the data in the different hospitals. However, this plan served as the basis for a number of studies. Insofar as this material covered most of the hospital facilities in a city, to that extent can rates based upon the population of the city be considered a reflection of the hospitalized illness which occurred in the city as a whole. It must be remembered, however, that this does not give a picture of total morbidity because only the more serious illnesses are hospitalized.

In 1939 Crosby presented the results of a study of rural hospital morbidity. It was emphasized that the data applied to the "hospital universe" only, but this study did for a rural hospital what Hoffman's study did for the Johns Hopkins Hospital.

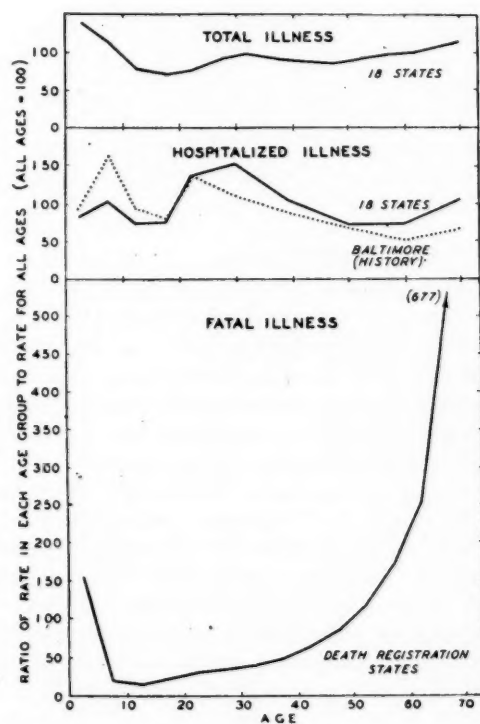
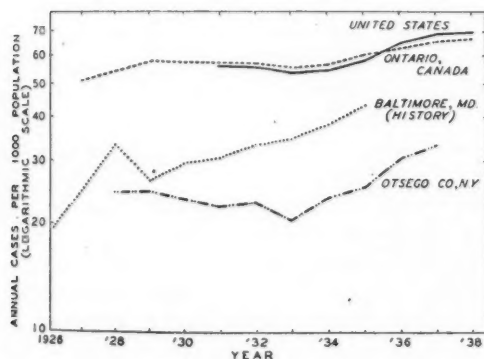
The studies mentioned up to this point have all started with a study of patients who had already been in the hospital. But in 1941 and 1943 Clara E. Council

presented the results of a study which combines "the use of survey and hospital data in that it starts with a survey group and proceeds to hospital sources of information for these persons." Here the idea of taking a known population and finding out what hospital service it receives was explored. The recent growth of hospital service plans, such as the Blue Cross, is making a wealth of material available for study of these problems. Several reports show what can be done with these data. Here again, "although these records pertain to a well-defined population, the rates are biased in that the persons studied are a selected group. Admission figures are higher than in the general population because, by the prepayment of fees, the economic barrier to hospitalization is considerably broken down." One still largely untapped source of morbidity statistics is the records of out-patients.

[Continued on page 16]

Relative variation with age in total, hospitalized and fatal cases of illness per 1,000 population—illness and hospital data from survey of 8,758 white families in 18 states, 1928-1931; hospital cases among 2,019 living white families in the Eastern Health District, Baltimore, in 8 hospitals, 1926-1935; mortality data for white population of Death Registration States, 1929-1930.

Annual hospital admissions per 1,000 population (excluding new-born and admissions to mental and tuberculosis hospitals)—United States, 1931-1938; Province of Ontario, Canada, 1927-1938; 2,444 living families in the Eastern Health District, Baltimore, in 9 hospitals, 1926-1935; resident discharges from Mary Imogene Bassett Hospital, Otsego County, New York, 1928-1937.



Federal Statistical Programs for the Current Fiscal Year

Numerous changes have been made in Federal statistical programs as a result of reductions made by Congress in agency appropriations for fiscal year 1948. Statistics are collected by many agencies of the Federal Government for administrative purposes, in performance of their statutory responsibilities, but collection of general-purpose data is centered primarily in four agencies—the Bureau of the Census in the Department of Commerce, the Bureau of Labor Statistics in the Department of Labor, the Bureau of Agricultural Economics in the Department of Agriculture, and the Bureau of Mines in the Department of the Interior. Principal changes in the programs of these four agencies are described briefly below.

DEPARTMENT OF COMMERCE

Bureau of the Census

Funds made available for the current surveys and general administration of the Census Bureau for the fiscal year 1948 amounted to \$6,940,000 compared to obligations incurred in 1947 of almost \$11 million and to the request for 1948 for \$13 million. In addition to eliminating all proposed expansions, the reduction in 1948 appropriations necessitated adjustments involving the elimination of some reports, and reduction in coverage, product detail or frequency of collection for others. Specific adjustments in the major current statistical reporting programs are summarized below.

Business statistics

The business statistics program provides current information on retail, service and wholesale trades. Beginning in 1939 the Census Bureau made available monthly trend information on retail sales for each of 34 states and for the 34 states combined. In early 1946 the Bureau undertook to develop an improved reporting program involving the systematic application of sampling principles designed to provide monthly dollar volume estimates of retail trade in the Nation as a whole and for all cities over 100,000 population. The program was introduced into the 68 sample areas also used in the Current Population Survey, with contemplated expansion of the number of sample areas to about 150. By June 1947 monthly trend information was available on total retail sales for the Nation as a whole and for 60 large cities. In addition trend data on total retail trade were published for 166 smaller cities.

Funds available for fiscal 1948 do not permit carrying out the planned expansion. The basic sample of

independent retail trade stores and service establishments will be limited to the 68 areas in which permanent Census Bureau field offices are maintained. Local reports will be continued for cities within the 68 sample areas, including 37 cities of over 100,000 population. Reports for the remaining 43 cities of over 100,000 population and the smaller cities outside the sample areas will be continued to the extent that local Chambers of Commerce or similar organizations can provide the assistance necessary to insure obtaining an adequate number of returns. It is expected that funds will be available to continue on a reduced scale the work intended to produce aggregate dollar volume estimates of retail trade. For the service trades, the following reports have been discontinued: automobile repair shops; barber shops; cleaning, pressing, alteration and repair shops; photographic studios; and shoe repair shops.

In the wholesale trade area, the quarterly report of lumber yards has been discontinued, and the monthly canned goods surveys have been limited to wholesale stocks of 14 principal food items.

Industrial statistics

The current industrial statistics program in the fiscal year 1947 consisted of 55 monthly, 20 quarterly and 17 annual commodity surveys. Data based on reports received from manufacturers are published in the Bureau's "Facts for Industry" series. The program proposed for 1948 would have expanded this program to include major products not adequately covered by governmental or non-governmental sources. New annual surveys were proposed for drugs and medicines, meat packing, rubber products and a number of important building materials. New monthly surveys were proposed for principal aircraft components, prepared animal feeds, prefabricated houses, flat glass and residential steel boilers. A number of new surveys were planned to fill informational gaps in the machinery and equipment field.

All plans for expansion of the current industrial statistics program in the fiscal year 1948 have been dropped, and it has been necessary to curtail the existing program in several areas. The principal modifications include: discontinuance of reports on concrete products and home and farm freezers; reduction of the frequency of collection from monthly to quarterly of a number of reports, including those on women's and misses' outerwear, women's and children's woven

underwear, knit outerwear products, and gloves and mittens; reduction in coverage of reports on cast iron products, steel castings, steel forgings, non-ferrous castings, construction machinery and flour milling; reduction of the amount of commodity detail in most of the remaining apparel reports and in surveys of textile and paper production, structural clay products, and a number of commodities in the intermediate metal products and machinery and equipments fields.

Population statistics

The current population statistics program supplies basic information on the size and characteristics of the population and on housing and its characteristics. During the fiscal year 1947 the programs included: (1) the monthly Current Population Survey of 25,000 representative households in 68 sample areas, providing data on the number and characteristics of persons in the labor force and on employment and unemployment; (2) an expanded national survey conducted in April 1947 yielding estimates of the population and its characteristics, the composition of the labor force, and housing conditions and facilities for the Nation as a whole and its major regions; (3) a total of 62 local area surveys relating to population, labor force and housing characteristics; (4) a survey of 1946 consumer income conducted in April 1947, producing estimates of the distribution and source of income of individuals and of family groups.

The revised 1948 program provides for the maintenance of the monthly Current Population Survey, with a limited number of supplements to produce current estimates of basic population characteristics. However, no national survey of the type conducted in April 1947 will be undertaken. There will be no survey of 1947 consumer income and no local area surveys of population, labor force and housing.

Foreign trade statistics

During the fiscal year 1947 statistics compiled under this program provided monthly and annual data on the quantity, value and shipping weight of the import and export trade of the United States by commodity groups, foreign countries, and non-contiguous territories. The proposed 1948 program was based on a continuation of the previous year's activities with increased allowance for the anticipated increase in the number of documents to be tabulated. Necessary curtailment in the final 1948 program affects principally shipping statistics. The collection of shipping weight information on exports and imports by methods of transportation other than vessel and air has been discontinued. For shipments by air, publication of monthly data showing commodity and country information on export and import shipments has been dis-

continued with the reports containing April 1947 data. Machine tabulations, however, will be available for reference purposes.

Work on the annual publication "The Foreign Commerce and Navigation of the United States" for the calendar year 1946 will be deferred, but it is anticipated that Volume I of the 1945 edition will be completed during the year. The revision of schedules A and B (the import and export commodity classifications), which was originally planned for the fiscal year 1948, cannot be carried out.

Government statistics

The finances, employment, organization, functions and services of the 48 states and 155,000 local government units in the United States are the principal subjects covered in this program. The principal changes in the 1948 program of governmental financial statistics involve the elimination of individual State reports, elimination in county finance reports of state-by-state totals and substantial reduction in the number of counties individually reported, and replacement of the 37 individual city bulletins by a single report on major city finances. Quarterly reports presenting national estimates of state and local government employment and payrolls will be continued, but the state-area breakdown will be available only on an annual basis.

DEPARTMENT OF LABOR

Bureau of Labor Statistics

The final appropriation for the Bureau of Labor Statistics for the fiscal year 1948 was \$3,473,400, compared to obligations incurred in the fiscal year 1947 of over \$5 million and to the budget request for 1948 of nearly \$6 million. Every phase of the Bureau's work was seriously affected by the reduction in funds. The major directions of the changes were: (1) substantial reduction in state and local statistics on employment, construction and housing in order to preserve as sound national data as possible; (2) recasting of the wage studies program; and (3) general reduction in the scope of all programs. More detailed effects of the budget cut are discussed below.

Prices and Cost of Living

Consumers' price index

The frequency of price collection for the 34-city index has been changed. Prices are collected monthly in only 10 of the cities and for the remaining 24 on a quarterly cycle, 8 of the 24 being priced each month. Quarterly collection of rent data has been resumed in each of the 34 cities, but on a less adequate basis than that which existed before rent control. Indexes for 5 "reconversion" cities, in which prices have been collected

semiannually, have been discontinued. Collection of monthly retail fuel prices has been discontinued in 21 cities not included in the list of 34 cities for which consumers' price indexes are prepared.

City worker's family budget

In the fall of 1945 study was begun on compiling the dollar total of a standard budget for a workingman's family; pricing of the budget was completed in 34 large cities during the fiscal year 1947, but the figures were not published. Pricing of the budget was scheduled for 15 additional cities but was not carried out when it became apparent that the 1948 appropriation would not permit continuation of the study. The 1948 request would have allowed repricing of the standard budget in the 34 large cities, completion of pricing in the 15 cities scheduled for 1947, and pricing in 35 additional small and medium-sized cities. Because of the budget cut no further studies will be made in 1948, but it is anticipated that the results of the studies completed will be published and if possible kept up to date by a short-cut method.

Wholesale price indexes

Work on the revision of the comprehensive index will be retarded. The index of dealer-to-contractor prices for building materials will be discontinued.

Import-export price indexes

Work started in 1946 on the preparation of indexes of the prices of commodities imported into and exported from the United States has been discontinued.

Index of prices of government purchases

Funds were requested in the 1948 budget to develop quarterly indexes, in cooperation with the major procurement agencies, of prices paid for commodities by the Federal Government. Funds will not be available for this project.

Wage Analysis

Industry wage studies

The number of establishments to be visited in connection with national industry studies will be reduced to about 3,000, and less detail will be obtained. In 1947, 12,000 establishments in 25 industries were visited. To supply the demand for local data, limited occupational and related wage data will be obtained from surveys of about 6,000 plants in manufacturing and non-manufacturing industries in important areas of concentration.

In 1947 special surveys were made of about 1,000 plants at the request of conciliators and arbitrators in dispute cases or of employers or unions for use in col-

lective bargaining. These studies will be discontinued except on an emergency basis.

Urban wage-rate index

In 1947 surveys were made to show national trends in basic occupational wage rates for 16 manufacturing groups and selected nonmanufacturing industries. Over-all wage rate indexes were prepared based on 69 important industrial areas, and separate indexes were published for 28 areas. This program is discontinued, and it is hoped that indexes based on establishment reports by mail of straighttime average hourly earnings can be substituted.

Industrial relations

This program will center almost exclusively on continuation of information on work stoppages, union membership and organization; and on the collection and analysis of collective bargaining agreements as related in part to requirements under the Labor-Management Relations Act of 1947.

Employment and Occupational Outlook

National and state employment statistics

The national employment statistics program will be continued without substantial modification. The primary effect of the budget cut will be the elimination of state estimates and the discontinuance of developmental work on estimates for local areas. State agencies cooperating with the Bureau in the collection of employment data, however, will be furnished technical assistance in the preparation of state and area estimates, and cooperative arrangements will be extended to additional states as rapidly as possible.

Employment and payroll indexes

This program will continue without substantial change. The primary effect of the budget cut will be to retard completion of the adjustment of individual manufacturing and nonmanufacturing series to make them comparable with estimates of total employment, and to delay reclassification of the manufacturing series to the Standard Industrial Classification.

Hours and earnings

The program for national data will continue without substantial change. Introduction of the revised Standard Industrial Classification for manufacturing industries will be delayed.

Occupational outlook studies

It is expected that occupational outlook studies will be made for 6 industries, as compared with 20 in the fiscal year 1947. Work in analyzing the labor force will also be curtailed.

Construction and housing

The sample of areas surveyed to determine the ratio of housing construction outside building-permit-issuing areas has been revised to produce only national estimates, and the local area data will no longer be available. In addition, there was a reduction of the field work designed to determine housing starts and to determine the distribution of construction activity over the months following starts. The series on housing completions will be discontinued.

Industrial hazards

The work on industrial accident statistics and on surveys of the causes of accidents in industries with a high accident rate will continue substantially unchanged. A proposed field study of the coverage and effects of workmen's compensation laws will not be made.

DEPARTMENT OF AGRICULTURE

Bureau of Agricultural Economics

Work of the Bureau of Agricultural Economics is divided into two principal areas—Agricultural Estimates and Economic Investigations. The amounts requested of Congress for each of these for fiscal year 1948 were substantially the same as the amounts which had been appropriated for fiscal year 1947, or a total of \$4,869,400. The amount finally appropriated was \$4,375,000, which represented the full amount requested for Agricultural Estimates and a reduction of 20 percent for Economic Investigations.

The \$2,375,400 requested for "Crop and livestock estimates" was granted by the Congress, and the basic programs of Agricultural Estimates will be maintained. During fiscal years 1946 and 1947 the Bureau made use of enumerative sample surveys to obtain data on farm income and expenditures, wages and employment, farm practices, and other topics difficult to survey by means of mail questionnaires. Although administrative supervision for these enumerative surveys is lodged in Agricultural Estimates, with its 41 State field offices, they are an overall Bureau concern and

supported in part by funds from Economic Investigations. The substantial reduction or elimination of funds formerly supplied by Economic Investigations will necessitate curtailment of the enumerative surveys in the current fiscal year. Tentative plans allow for only one large-scale field survey to be taken next spring, if funds are available. Other changes made in the Bureau's Economic Investigations Program include curtailment or postponement of statistical and analytical work in the fields of agricultural finance, land economics, farm management and costs, statistical research, and farm population and rural welfare.

DEPARTMENT OF THE INTERIOR

Bureau of Mines

Statistical work of the Bureau of Mines is centered under "Economics of Mineral Industries". The Bureau is responsible for collection and analysis of data on metals, non-metals, petroleum, coal, foreign minerals, and mine accidents. The final appropriation for this program for the fiscal year 1948 was \$680,000, representing a 24 percent reduction in funds from the \$898,630 appropriated for the fiscal year 1947 and a 45 percent reduction from the budget request of \$1.2 million.

There will be a substantial decrease in published data available, particularly on bituminous coal. The number of tables on bituminous coal in the coal chapter of the *Minerals Yearbook* will be reduced from the 42 included for 1945 to 19 for 1946. Programs proposed for the fiscal year 1948 which cannot be undertaken include: collection of annual data on certain strategic and critical minerals for which data are not now available; extensive improvements in the publication of statistical and economic data on foreign governments; special surveys on the domestic oil industry similar to those published before the war; preparation of analytical reports on foreign minerals for the use of policy-making agencies responsible for the development of economic foreign policy; and analysis of the current descriptive reports for more adequate information on the causes, frequency and severity of mine accidents.

STATISTICAL PRACTICES IN HOSPITALS continued from page 10

Need for development of hospital statistics

It has been shown how in recent years many of the obstacles to the development of hospital statistics have been broken down. Classifications of disease have been developed which permit more ready combination of the statistics of many hospitals, mechanical procedures for handling large masses of data have been perfected, and the medical man and medical environment have

become more and more statistically minded and appreciative of the requirements of hospital statistics. Much still needs to be done, but hospital statistics are on the threshold of a tremendous development and "hospital horizons are expanding."

It is to be hoped that the need for more trained personnel in this area will be recognized by those young people who are seeking fields in which they may pursue a promising career.

QUESTIONS and ANSWERS

edited by **FREDERICK MOSTELLER**
Harvard University

OIL CONSUMPTION AVERAGES

Question 3. We are applying statistical methods to taxicab fleet operation and we have recently encountered a problem on which we would appreciate your advice.

We have in operation a number of cabs on which we are conducting oil consumption tests. This test involves 12 cabs. In other instances we may use as many as 135 vehicles.

We wish to use the standard deviation as a measure of dispersion of oil consumption expressed in miles per gallon. Since the miles traveled in a given period—i.e. one month—is different for each cab, we use the weighted average to express miles per gallon of oil for the group. This of course is different from the simple average and may vary 200 miles per gallon or more.

Which average should be used in calculating the standard deviation? We have used both values in calculating this statistic and find that there is no consistent relation between deviations obtained from the two averages.

Answer. The weighted mean should be used. This question is typical of a large class of problems in industrial statistics, in that the main interest lies in the selection of the appropriate mathematical model; once the selection has been made, the rest is relatively easy. In this particular case the statistician has to decide (a) what system of weights he shall use, and (b) how confident he is that those weights are the right ones.

Let y_i be the number of miles run by the i th cab during the test period, x_i the number of gallons of oil consumed, b_i the ratio y_i/x_i (the observed miles-per-gallon for that particular cab and test) and n the number of cabs in the test. If now $S(y)$ is the total mileage recorded by all the n cabs, and $S(x)$ the total oil consumed, a reasonable weighted average to estimate mean oil consumption appears to be

$$b = S(y)/S(x).$$

This system of weighting assumes that y_i has a variance proportional to x_i ; but even should the true weights be otherwise, b will still be unbiased provided only that y_i has the expectation bx_i .

Before we proceed to calculate a variance (or standard error) for b , we need to know what use is to be made of the statistic. It is easy to think of at least four possible uses, corresponding to the following questions:

(1) How close is this estimate b to the "true value"?

INFINITE OBSERVATIONS

Question 4. In certain kinds of psychological experiments, for example word-association tests, the time to reaction is measured. In spite of careful instructions to subjects there are occasions where infinitely long reaction times are

(2) Is b significantly different from another value obtained in a previous experiment?

(3) How much variation might we expect between successive tests on a particular taxicab?

(4) If we have data for a cab not included in the test, how can we test whether this cab's oil consumption is excessive?

It does not appear from the question which (if any) of these is the chief interest, but to me No. 4 seems a likely choice. Now, the appropriate variance will include a component due to variation in the types of trip made by any one cab; we have assumed that this component is proportional to the oil consumed. If this were the only component of variance, and if we had considerable confidence that our weights were the right ones, we would use the weighted sum of squares to estimate it. Actually, there will certainly be a component due to the cab, which has presumably been chosen at random from the fleet; in general, we expect oil consumption to be influenced by the cab's age and accident history. There may be an additional component due to the driver, and perhaps still others. The total variance will be compounded from these elements, and while we could conceivably make the trip variance of a mean as small as desired by accumulating enough mileage, the cab and driver errors would be unaffected. It accordingly seems to me better, in estimating this variance, to use unweighted deviations from the weighted mean. We might then attach to y an estimated variance

$$s_y^2 = \frac{S(y_i - bx_i)^2}{n-1}$$

obtaining the standard error by extracting the square root. If now we get a new observation (x_j, y_j) and wish to test whether the j th cab is using too much oil, we might use the ratio

$$\frac{y_j - bx_j}{s_y \sqrt{1 + \frac{x_j^2}{n \bar{x}^2}}} \quad \left(\bar{x} = \frac{S x_i}{n} \right)$$

as an approximate test. This is pretty rough statistics, especially with s_y^2 known only with 11 degrees of freedom; the statistician would do well to start by choosing a tentative action limit, revising it on the basis of reports from the maintenance shop. Better still would be to perform a more searching experiment designed to estimate the different components of variance.

Paul Peach

psychologically interesting, but they complicate the analysis of the data. They are especially awkward when an analysis of variance is being performed. What can you suggest about handling such observations?

Answer. It may be illuminating to compare this problem with one involving a "rat race". L. P. Crespi, (*American Journal of Psychology*, 55, 1942, pp. 467-517) studied the effect of the amount of reward on the speed with which a rat would cover a certain course—sometimes the rat sat still! Here, the use of the reciprocal of the time of running led to a very smooth and effective analysis. I suggest that

you calculate $100/(\text{time to reaction})$ and then analyze these figures.

This may not be the best thing to do, since some further transformation may be even more helpful (by bringing the "finite" data more nearly to a normal distribution), but the difficulty with infinity had been eliminated, and if less than 10%, or perhaps 20% of your cases are "infinite", ordinary methods of analysis will usually serve.

For those who like "a word for it", I suggest that a reciprocal second be called a "whiz". Thus a time to respond of 4.0 seconds is scored as "0.25 whiz" or "250 milliwhizzes". If the analysis is made in terms of $100/(\text{seconds to reaction})$ the measurements are in "centiwhizzes".

John W. Tukey

RUNS UP AND DOWN

Question 5. I have opinion data from a number of representative samples of the same large population of people. The samples themselves are composed of different people. On some surveys a certain question was asked, on other surveys a similar but different question was asked. In analyzing the data so gathered I get several short sequences of percentages (indicating percentage in favor of the particular issue proposed). For example, see the table below.

In each case the occasions on which a question was asked were spaced over approximately the same time interval. That is, the time interval from the first time Question 4 was asked to the last time it was asked overlaps the time intervals on which all the other questions were asked. The occasions of asking the other questions are similarly spaced out over this

time interval.

I have inserted a plus sign between occasions when the percentage in favor of the issue increased and a minus sign between occasions when the percentage decreased.

It seems to me that there is a general tendency for the percentages to increase from the beginning of the time interval to the end. I have a great deal of such data. Consequently I would like a quick way of testing whether I should accept such gradual increases as real.

The question might be put more generally. Given several independent short sets of data, temporally ordered, how can I test the hypothesis that these data are randomly ordered against the alternative that there is a tendency for the observations to increase the later they are taken?

Question	Occasion of asking											Number of plus signs <i>n</i> ₊	Number of minus signs <i>n</i> ₋	Times asked <i>n</i>	
	1	2	3	4	5	6	7								
1	31	-	27	+	29	+	34	+	35	+	42		4	1	6
2	24	+	26	+	28								2	0	3
3	24	+	35	-	29	+	36	+	43				3	1	5
4	21	+	31	+	35	+	36	+	47	+	54	-	44	1	7
Totals													14	3	21

Answer. There are many different ways of testing the hypothesis proposed, none of which is entirely satisfactory.

If we let N_+ be the total number of plus signs, N_- the total number of minus signs, and k the number of different questions or sets of data, we might use as a normal deviate

$$|t| = \frac{|N_+ - N_-| - 1}{\sqrt{(N_+ + N_- + 2k)/3}}$$

When there are many more of one sign than of the other this test will yield significant results. In the example at hand the result is

$$|t| = \frac{|14 - 3| - 1}{\sqrt{(14 + 3 + 8)/3}} = 2\sqrt{3} = 3.46.$$

This is a highly significant result. There are too many plus signs for one to retain the hypothesis of a random arrangement of numbers.

This formula comes about in the following manner. If a

sample of size n is randomly drawn, the expected number of plus signs is $m = (n-1)/2$. The variance is $\sigma^2 = (n+1)/12$. Consequently if we have k samples of size n_i , $i=1, 2, \dots, k$, the expected total number of plus signs is $M = (\sum n_i - k)/2$, and the variance of the observed number of plus signs, N_+ , will be the sum of the variances for the individual samples, or $\sigma^2(N_+) = (\sum n_i + k)/12$. We can expect the significance levels of the distribution of N_+ , assuming random arrangement, to be approximately given by the normal distribution with mean M and variance $\sigma^2(N_+)$. So we use as a normal deviate:

$$|t| = \frac{|N_+ - M| - \frac{1}{2}}{\sigma(N_+)}$$

If we replace the total number of observations N by its equal $N_+ + N_- + k$ it is possible to rearrange this formula for $|t|$ and get the one first given.

Frederick Mosteller

The Perils of Perspective

by KENNETH W. HAEMER

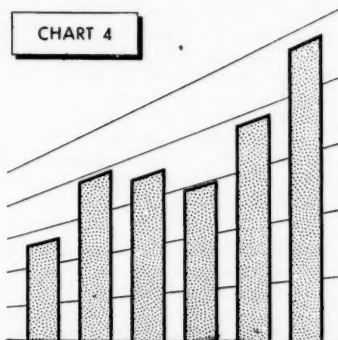
The urge for novelty in charting is a good thing. New and better ways are always worth seeking. But novelty for novelty's sake is another matter, especially when it takes a form that confuses or distorts the picture. The use of perspective is a technique that very often manages to do both.

It is true that perspective is eye catching, that it permits a more interesting composition, and that it fulfills the request for "something different" that so often confronts the chartist.

It is also true that charts drawn in perspective usually are difficult to read with even approximate accuracy. In fact, by choosing an appropriate perspective, an increasing series actually can be made to appear to run down hill or a decreasing series be made to run uphill.

Chart 1 shows a series of data presented in the conventional manner. Chart 2 is the same series plotted in pseudo perspective. (A tapering grid, but with vertical rulings equally spaced.) Chart 3 shows the same series plotted in true perspective (vertical rulings unequally spaced because of foreshortening). It can readily be seen that the distortion is bad in Chart 2, worse in Chart 3.* Even a sharp-eyed skeptic, aware of the kind of distortion produced by this treatment, would have difficulty in translating these specimens mentally into the true picture. If the unwary reader gets anything resembling the facts from either, it is a miracle.

Of course, many perspective charts stop short of the extreme angle used in these two examples; but it is possible to use a less acute angle and still get into difficulty. Chart 4 illustrates an apparently harmless variety. Sponsors of this type admit

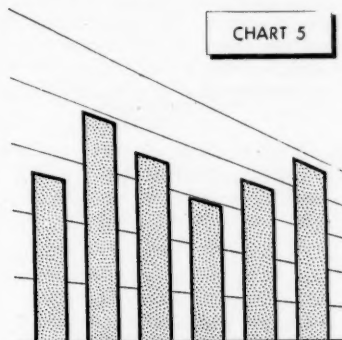


that the action is a trifle exaggerated, but maintain that inasmuch as the series does increase anyway, the perspective merely heightens the effect. It does indeed. The extent of the heightening is most clearly brought out by showing the same data in exactly the opposite perspective, as in Chart 5. In one recent report, perspective 4 was used to show payroll expense, and perspective 5 to show corporate earnings, which is certainly playing both ends against the middle. In this particular case, the facts were impressive enough without the distortion which merely cast suspicion on an otherwise good story.

These few examples do not complete the range of perspective variations, but they do demonstrate the

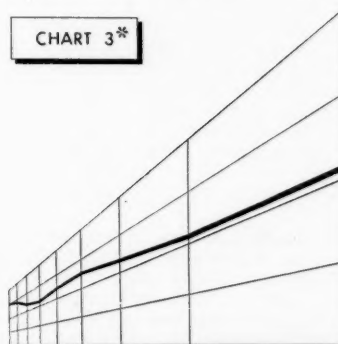
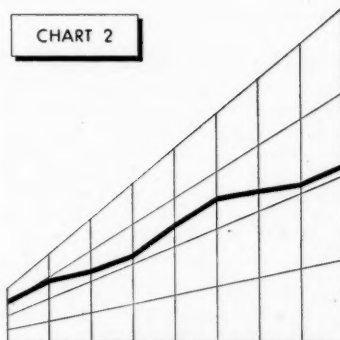
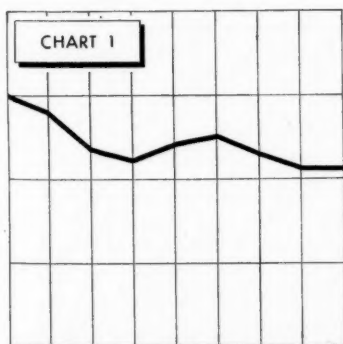
danger of departing from the standard head-on form of presentation.

If perspective must be used—and it does have proven attraction value—it should be used with restraint. A slight rather than a sharp convergence provides definite novelty with



negligible distortion. Also, perspective should be used consistently: that is, the same perspective for all charts in the presentation. Any resultant overstatement or understatement of the data will thus be uniform throughout. In any event, horizontal scale rulings should be used to enable the reader to check the visual impression, and to evaluate the plottings.

* To be strictly accurate, Chart 3 is not a perfectly true perspective picture of the rectangle in Chart 1: if it were, it would be somewhat narrower. However, Chart 3 is drawn in true perspective. It has been drawn full column width for convenience of comparison.



NEWS about MEMBERS

- B W. D. Baten**, formerly of Michigan State College, is now Chief, Operations Branch, Planning Section, Air Defense Command, Mitchel Field, New York. **Raymond Bowers**, formerly Chief of the Research and Statistics Division in the Selective Service System, has joined the staff of the Mental Hygiene Division of the Public Health Service. **Paul T. Bruyere** is now Chief of the Medical Records and Statistics Branch, Army Institute of Pathology, Office of the Surgeon General, War Department.
- C Albert S. Cahn** has been appointed Executive Officer of the Institute of Numerical Analysis recently established by the National Bureau of Standards. **Benjamin Caplan**, formerly with the Office of Price Administration, has joined the staff of the Council of Economic Advisers and will work on prices. **C. F. Carter** is lecturing in Statistics at the University of Cambridge, England. **Edmund Churchill**, formerly on the staff of Rutgers University, New Brunswick, New Jersey, has joined the staff of Antioch College at Yellow Springs, Ohio. **Frederick M. Cone** has been named Chief of the Industrial Census Staff in the Bureau of the Census. **John H. Curtiss** has been named chief of the recently established National Applied Mathematics Laboratories at the Bureau of Standards.
- D B. DeLury** has left Virginia Polytechnic Institute at Blacksburg to return to Canada. He is now with the Ontario Research Foundation, an endowed institution at 43 Queens Park, Toronto. **Samuel J. Dennis**, Chief of the Construction Economics Unit in the Office of Domestic Commerce, is on loan for four months to the Division of Statistical Standards of the Bureau of the Budget to direct a review of Federal statistics on construction. **Julian S. Duncan**, who has been doing economic research for the Interstate Commerce Commission, left Government service in November. He will be Executive Director of North American Transport Research, Inc. The firm will do consulting work in all fields of transportation. Associated with him in the enterprise is Dr. I. N. Danielian, a specialist in water transportation.
- E Churchill Eisenhart** has been appointed head of the Statistical Engineering Laboratory of the Bureau of Standards' National Applied Mathematics Laboratories. **Albert A. Eisenstat**, formerly with the Bureau of the Census, has resigned from the Industry Division to enter private business. **William H. England** has retired as Chief Economist of the Federal Trade Commission.
- H George W. Hervey** has been appointed director of the Statistical Division of the newly organized National Blood Program of the American Red Cross. This program will provide blood and blood derivatives, without charge for the products, throughout the nation. Dr. Hervey will institute modern procedures for the collection and analysis of all relevant data pertaining to blood collection and the fractionation of blood.
- J Raymond J. Jessen** has been appointed Acting Director of the Statistical Laboratory at Iowa State College, to succeed Professor **George W. Snedecor**.
- L Julius Lieblein**, formerly with the Division of Tax Research in the Treasury Department, is now with the National Bureau of Standards. **Arnold N. Lowan** has been appointed chief of the Computation Laboratory of the National Bureau of Standards. This laboratory is one of the four units making up the newly established National Applied Mathematics Laboratories.
- M Cyrus A. Martin** is now an administrative analyst and statistician, assisting The Chief of Personnel Control of Signal Corps, in Washington, D. C. **Jack Moshman** has been appointed to the staff of the Department of Mathematics, University of Tennessee.
- N Munroe L. Norden** has left the Ballistic Research Laboratories at the Aberdeen Proving Ground, Md., to accept a statistical research position with the Douglas Aircraft Company at Santa Monica, Calif.
- O Douglas W. Oberdorfer** of the Division of Statistical Standards, Bureau of the Budget, has been named to serve as alternate on the Interagency Committee of the Food and Agriculture Organization of U.N. **A. L. O'Toole** has left the Veterans Administration to join the staff of Young and Rubicam, New York.
- P R. E. Patterson** is now Assistant Director, Texas Agricultural Experiment Station, College Station.
- R Edmond A. Radsliff**, formerly with the Institute of Child Welfare at the University of California at Berkeley, has joined the staff of the Department of Experimental Statistics at Raleigh, North Carolina. **David Rosenblatt** of the Bureau of the Budget has accepted a fellowship at the Littauer School of Harvard University.
- S Henry Scheffé**, who has been on leave for the past year, returned to his position in the Engineering Department, University of California at Los Angeles. **Edward M. Schrock** has accepted a position as Quality Control Engineer with the General Electric Company at its Erie Works, Erie, Pa. **Raymond F. Sletto**, has left the University of Minnesota to accept a Professorship of Sociology at Ohio State University. **G. W. Snedecor** retired July 1 as head of the Statistical Laboratory, Ames, Iowa. He will remain associated with the Laboratory as research professor during the school year, continuing his teaching and consulting activities. His retirement comes 14 years after the Laboratory was founded in 1933. Professor Snedecor early took the lead and has done more than anyone else in this country toward promoting the application of modern statistical methods to biological research. **Jerome R. Steen**, who has been manager of Quality Control Engineering with the Sylvania Electric Products in Emporium, Pa., has now transferred with the same company to Flushing, New York. **Ernst W. Swanson**, who has been in charge of the Economic Research Department of the U. S. Chamber of Commerce, has left Washington to join the staff of the College of Business Administration, Butler University, Indianapolis.
- W George A. Wagoner** has left Indiana University to become Associate Professor of Business Education at the College of Business Administration, University of Tennessee. **R. Clyde White**, Professor of Public Welfare, School of Applied Social Sciences, Western Reserve University, has been granted a leave of absence from the University, beginning in February, to direct a portion of the work on the Greater Boston Health and Welfare Survey. **John Wishart**, Reader in Statistics, has resumed lecturing to mathematicians and to biologists at the University of Cambridge, England.

CHAPTER NOTES

NEW YORK

New York Chapter Plans a New Program

The New York Chapter is developing an expanded program to serve better the interests of its members. In the best research tradition, we surveyed the local membership for their backgrounds and areas of interest as a basis for a varied and pertinent agenda. We have also compiled a list of members in different fields who can be called upon to take an active part in the new program.

The present membership of nearly 1100 is distributed percentage-wise in the following major fields.

Field	Percentage
Business	42.5
Finance	20.1
Education	15.6
Government	8.3
Social	7.4
Professional	1.6
Miscellaneous	4.5
Total	100.

In order to meet the demands of these many fields, chapter activities are now grouped into five divisions as follows:

Biometrics

—under Dr. Edwin J. deBeer

Business Economics

—under Dr. Ralph J. Watkins

Financial Markets

—under Mr. Leo H. Rich

Social Statistics

—under Dr. Neva R. Deardorff

Statistical Techniques

—under Dr. Irving D. Lorge

A sixth division formerly called "Local Statistics" is now known as the "Committee on Metropolitan Business Statistics" under the leadership of Dr. Meredith B. Givens.

Committees in action

The Committee on Metropolitan Business Statistics, under the chairmanship of Dr. Meredith B. Givens, is ferreting out the various applications to which local statistics are being put in this area.

The Advisory Committee of the Social Statistics Division under the direction of Dr. Deardorff is coordinating the suggestions from this area on the 1950 census of population and housing. Dr. Deardorff has gained full cooperation in this effort from the Regional Plan Association. A memorandum on the needs of this community (reproduced at the end of this article) has

been transmitted to the U.S. Bureau of the Census.

The Committee on Structure under the chairmanship of Professor Helen M. Walker of Columbia University, is revising the chapter structure to fit it into the new national Constitution of the A.S.A.

The Committee on Placement, headed by Frank Lang of the Association of Casualty and Surety Companies, is developing a valuable service both to members seeking jobs and to prospective employers.

The Committee on Publicity, headed by A. Edward Miller of *Life Magazine*, is responsible for press releases on meetings, talks and other chapter activities. It will assist in the publicity for the Annual Meeting of the A.S.A. in New York in December. The work of this committee will be coordinated with the job of chapter editor for this magazine. Milton Stevens has accepted appointment to that post. He will report the activities of this chapter and also solicit and edit material for publication.

The Committee on Membership, headed by Robert R. Behlow of the U. S. Bureau of Labor Statistics, is planned to stimulate interest from new sources in the New York Chapter and the national organization.

The Committee on Arrangements is to aid the Chapter Secretary in planning meetings and will assist with the details for the Annual Meeting of the Association to be held here in December. In this connection, we regret that Mr. Charles W. Haynie could not continue his work as Secretary. Robert E. Lewis, Federal Reserve Bank of New York, has been appointed to serve out the balance of 1947. However, Mr. Haynie will continue as Treasurer for this year.

Meeting schedule of divisions

The first dinner meeting of the Chapter's 1947-48 season was held on November 13 under the joint sponsorship of both the Financial Markets and the Business Economics Divisions. "Two Major International Problems and their Economic Implications: Atomic Energy Control and the Marshall Plan" was the subject.

The new Division of Biometrics held its first program meeting on November 10. Preliminary plans call for monthly meetings of this Division in the future.

Two meetings are scheduled for each of three larger divisions (Financial Markets, Business Economics and Social Statistics) during the coming year of 1948. Interspersed with these meetings will be five meetings of the Statistical Techniques Division. The first of this series scheduled by this Division was held in November on the subject of the Sampling of Human Populations.

Memorandum to Bureau of Census on 1950 Census

The New York District Chapter of the American Statistical Association on September 8 submitted the following recommendations to the U. S. Bureau of the Census on the tabulations of the 1950 returns:

- "1. That at least all of the 1940 tabulations of data on population and housing for health areas, census tracts, and blocks be repeated for New York City.
- "2. That at least all of the additional 1940 tabulations of data on population, characteristics of families, employment, occupation, labor force, income, education, and citizenship, including the data based on sampling, be repeated for each of the boroughs in New York City.
- "3. That single-year age classes be tabulated for the population under 20 years for each census tract, but that such a detailed tabulation need not be published if it can otherwise be made readily accessible to users in this area.
- "4. That if data on income are collected and tabulated for persons and families in New York City, such data be tabulated for census tracts, with at least the median income reported for each tract.
- "5. That if data on migration are collected and tabulated, such data show migration from one borough to another within New York City as well as between each of its boroughs and each of the other counties in this Metropolitan area and between these counties and the states.
- "6. That all classifications of the above census data be made uniform for all of the 22 or more counties comprising the New York Metropolitan area as it may be established for the 1950 census, (the 22-county area being that as defined by the Regional Plan Association Inc.)"

ALBANY

The Albany Chapter of the American Statistical Association is offering the following three courses in Statistics for 1947-1948 (for description of chapter project see *ASA Bulletin*, May 1947):

I. Pre-statistics. This course covers elementary, algebra, logarithms, and elementary concepts of statistics.

II. Elementary statistics. This covers elementary statistics through Moments and Frequency Curves.

III. Advanced statistics. This course deals primarily with index numbers, cyclical seasonal and other fluctuations, curve fitting, correlation, chi square, and variance analysis.

Upon completion of any of the above courses and passage of the examination, an appropriate certificate will be issued. The text book which will be used in Courses II and III is *Elements of Statistical Method* by Waugh.

CHICAGO

A series of dinner meetings are being planned to draw upon outstanding statisticians throughout the country. The first of these was held on October 8,

with Colin Clark, Director of the Queensland, Australia, Bureau of Industry, Government Statistician and Financial Advisor to the Treasury, and formerly University Lecturer in Statistics at Cambridge University, as the speaker. Mr. Clark has an international reputation as a statistician and economist.

His topic was "The Pace of Economic Progress". New developments in the concepts of national income were stressed, with particular reference to the discussions of the International Statistical Conferences.

HAWAII

The constitution of the new chapter in Hawaii has been officially accepted by the Board of Directors of the American Statistical Association. The officers for the year 1947-48 were elected at a meeting on August 7 and are as follows: President—John F. Child, Jr., Business Survey and Research Service, Honolulu; 1st Vice-President—Chester K. Wentworth, Board of Water Supply, City and County of Honolulu, T.H.; 2nd Vice-President—Keith A. Hill, Hawaiian Air Material Area, Hickam Field, Oahu, T.H.; Secretary-Treasurer—Miss Margaret S. Wright, Bureau of Vital Statistics, Board of Health, Honolulu, T.H.

WASHINGTON STATISTICAL SOCIETY

The Washington Statistical Society has arranged two meetings on new electronic computing machines. The first meeting, held on October 27, covered "Recent Developments in High Speed Automatic Computing Machinery". Two papers were given, one on "The National Machine Development Program" and one on "Application of Statistical Tabulation Problems."

For the benefit of those interested in a more detailed discussion on statistical applications a supplementary meeting was arranged for November 10 on "Problems in the Use of Highspeed Computing Machines in Statistical Work". Papers for this meeting included one on "Design of Instructions Codes" and another on "Programming of Problems for Machine Solution."

1947-8 Washington Committees

Executive Committee—Harold Wolkind, War Department; Earl E. Houseman, Bureau of Agricultural Economics; John H. Curtiss, Bureau of Standards. Program Committee—Peyton Stapp, Bureau of the Budget; A. Ross Eckler, Bureau of the Census; Kenneth B. Williams, Federal Reserve Board.

American Statistical Association 107th Annual Meeting

New York City, December 28-30, 1947

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